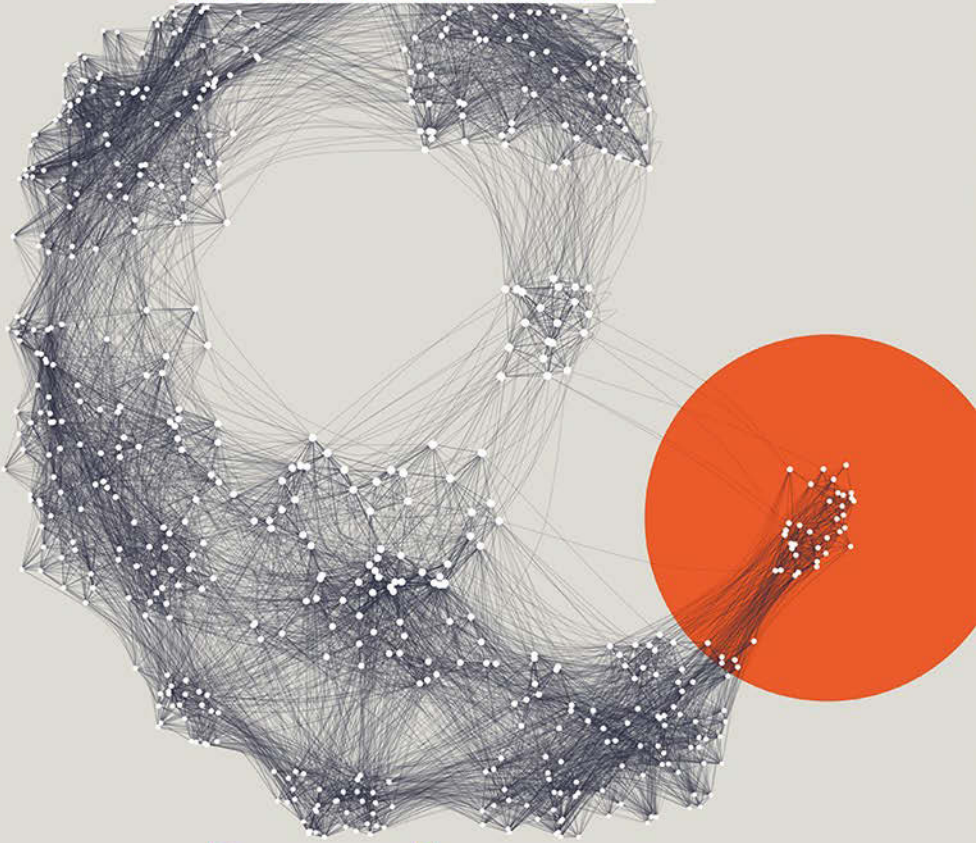
SONJA THIEL,
JOHANNES C. BERNHARDT (EDS.)

AI IN MUSEUMS

REFLECTIONS, PERSPECTIVES AND APPLICATIONS



[transcript] → Museum

Sonja Thiel, Johannes C. Bernhardt (eds.)

AI in Museums

Reflections, Perspectives and Applications

[transcript]

Funded by the Federal Government Commissioner for Culture and the Media.

Die Beauftragte der Bundesregierung für Kultur und Medien

Bibliographic information published by the Deutsche Nationalbibliothek
The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at https://dnb.dnb.de/

This work is licensed under the Creative Commons Attribution 4.0 (BY) license, which means that the text may be remixed, transformed and built upon and be copied and redistributed in any medium or format even commercially, provided credit is given to the author.
https://creativecommons.org/licenses/by/4.0/
Creative Commons license terms for re-use do not apply to any content (such as graphs, figures, photos, excerpts, etc.) not original to the Open Access publication and further permission may be required from the rights holder. The obligation to research and clear permission lies solely with the party re-using the material.

First published in 2024 by transcript Verlag, Bielefeld
© Sonja Thiel, Johannes C. Bernhardt (eds.)

Cover layout: Maria Arndt, Bielefeld
Cover illustration: Astibuag / Adobe Stock
Language Editing & Proofread: Amy Klement
Printed by: Majuskel Medienproduktion GmbH, Wetzlar
https://doi.org/10.14361/9783839467107
Print-ISBN: 978-3-8376-6710-3
PDF-ISBN: 978-3-8394-6710-7
ISSN of series: 2702-3990
eISSN of series: 2702-9026

Printed on permanent acid-free text paper.

Contents

Foreword
Johannes C. Bernhardt and Sonja Thiel 9

Introduction
Johannes C. Bernhardt and Sonja Thiel 11

Part 1: Reflections

The Role of Culture in the Intelligence of AI
Mercedes Bunz 23

Why AI Cannot Think
A Theoretical Approach
Daniel M. Feige 31

AI and Art
Arguments for Practice
Arno Schubbach 41

The Hidden Costs of AI
Decolonization from Practice back to Theory
Oumaima Hajri 57

Dead End or Way Out?
Generating Critical Information about Painting Collections with AI
Lukas Fuchsgruber 65

Power, Data and Control
AI in the Museum
Oonagh Murphy 73

Managing AI
Developing Strategic and Ethical Guidelines for Museums
Sonja Thiel 83

Museum-AI Assemblages
A Conceptual Framework for Ethnographic and Qualitative Research
Christoph Bareither 99

Part 2: Perspectives

AI *with* Museums and Cultural Heritage
Baptiste Caramiaux 117

Troubleshoot?
A Global Mapping of AI in Museums
Isabel Hufschmidt 131

Digital Curation and AI
Opportunities and Risks for Cultural Heritage Institutions
Clemens Neudecker 149

Teaching Provenance to AI
An Annotation Scheme for Museum Data
Fabio Mariani, Lynn Rother, Max Koss 163

The Funding Program LINK—AI and Culture
Five Lessons Learned after Five Years
Tabea Golgath 173

Discovering Culture with AI
Luba Elliott 181

Post-Truth
Archives, GPT-2 and Fake News
Marion Carré 187

Impostor Syndrome
GPT-3 between Fact and Fiction
Roland Fischer 199

Part 3: Applications

Algorithmic Exhibition-Making
Curating with Networks and Word Embeddings
Tillmann Ohm 209

Evaluating the Blackbox
Linking Viennese Art through AI
Nicole High-Steskal and Rainer Simon 217

Clouds of Symbols
The Digital Curator Project
Lukáš Pilka 225

xCurator
AI-Supported Exploration and Curation of Digital Collections
Sonja Thiel and Etienne Posthumus 233

Say the Image, Don't Make It
Empowering Human-AI Co-Creation through the Interactive Installation *Wishing Well*
Yannick Hofmann and Cecilia Preiß 245

CHIM—Chatbot in the Museum
Exploring and Explaining Museum Objects with Speech-Based AI
Oliver Gustke, Stefan Schaffer, Aaron Ruß 257

With AI to Art!
Chatting with Helen of Troy and Co. through IBM Watson
Melanie Fahden and Anja Gebauer 265

Exploring Beyond the Exhibits
Creating Knowledge for Social Robots in Public Spaces
Ana Müller, Michael Schiffmann, Anke Neumeister, Anja Richert 273

Tracking the Visitor
An Optical Indoor System for Visitor Research in Museums
Franz Koeferl, Matthias Zuerl, Jitin Jami, Jindong Li, Dario Zanca, Bjoern Eskofier 287

Symotiv
Virtual Insights into the Symphony Orchestra
Michael Zöllner, Markus Bosl, Dirk Widmann, Moritz Krause 295

Notes on Contributors 303

Abstracts 311

Introduction

Johannes C. Bernhardt and Sonja Thiel

Dan Brown opens his 2017 novel *Origin* with an enigmatic scene: the main character, Robert Langdon, visits the Guggenheim Museum Bilbao to attend a spectacular revelation on the origins of humanity by the tech billionaire Edmond Kirsch. Upon arrival, Langdon is given a headset developed by Kirsch, the use of which is mandatory for all participants in the event in order to experience a personalized tour of the museum. After putting it on, the artificial intelligence Winston introduces itself, welcomes Langdon, and explains Kirsch's idea: 'He designed this system specifically for museums, in hopes of replacing group tours, which he despises. This way, every visitor can enjoy a private tour, move at his own pace, ask questions he might be embarrassed to ask in a group situation. It is really much more intimate and immersive' (Brown 2017, 29). Of course, this does not end with the art chat; during the event, there is an assassination attempt and a mysterious hunt unfolds around the globe, into which all clichés about the superiority of AIs and transhumanism are interwoven. But whatever one might think about Brown and the quality of his mystery thriller: What was still science fiction in his museum scene in 2017 now seems so much closer with the release of ChatGPT.

The influence of AI is already pervasive as a technological and societal phenomenon. In fact, it permeates more or less every facet of human life, and its impact will surely intensify in the coming years. Its influence is spurring shifts in international markets and changing the shape of jobs and industries worldwide (Chui/Hazan/Roberts et al. 2023); creative fields like film, literature, and art are also evolving under its sway, producing new forms of expression, learning, and narratives as well as shifting our understanding of culture itself (Deutscher Kulturrat 2023). Currently, multiple scientific disciplines are engaged in its study and advancement, underscoring the fact that AI has evolved beyond a purely technical domain exclusive to computer science and research (Budelacci 2022; Deutscher Ethikrat 2023). A more inclusive approach acknowledges its multifaceted nature and views the field as an atlas, providing a platform to explore and cultivate diverse conceptualizations, applications, methodologies, and effects, and to unravel power structures and resistance towards technology and its phenomena (Crawford 2021)—all this will continue to change the cultural sector (Hochscherf/Lätzel 2023).

There is no such thing as *one* artificial intelligence. In his fundamental study of 1950, Alan Turing argued that the thinking of intelligent humans could not be precisely defined and therefore any output of a machine that cannot be recognized as such by humans should also be regarded as intelligent (Turing 1950; Vater 2023); a little later, the research field of artificial intelligence was established at the famous Dartmouth Workshop of 1956 (McCorduck 2004; Moor 2006). Since then, the concept of AI has changed again and again, been differentiated into subfields such as expert systems, speech recognition, or computer vision, and experienced booms and busts (Nilsson 2004; Seising 2021). AI functions as an umbrella term for a multitude of technical approaches that are often taken as a provocation of human intelligence and regularly trigger both fantasies and fears. If one speaks less far-reaching of systems that follow algorithmic rules, recognize patterns in data, and solve specific tasks, the challenges to human intelligence and related categories such as thinking, consciousness, reason, creativity, or intentionality pose themselves less sharply. The only thing that has changed dramatically in recent years is that such systems—from simple machine learning to the development of neural networks and large language models—have achieved a level of complexity and efficiency that often produces astonishing results. But to view this correctly, it is necessary to think the other way round than Turing did: The results may look intelligent, but they are not. And this leads to the core of the problem for the cultural sector and the still missing piece in Brown's enigmatic museum scene: the approaches of AI are based on mathematical principles, logic, and probabilities, while culture is about the negotiation of meaning and ambivalence. The central question is therefore what strategies the cultural sector can utilize to gear these approaches to the production of meaning and to synthesize them into something like *cultural intelligence*.

Using approaches of AI raises also many other questions. Generative image production, for example, raises new questions about copyright, and the question of accessibility and provision of data thus takes on a new urgency, while authorship is being renegotiated and the forms of knowledge production are changing on a fundamental level. In this era of transformative development, the brisk pace of technological and societal changes necessitates active and socially inclusive strategies. Regulation and certification, while important, are not sufficient in themselves. The need of the hour is a vibrant and inclusive discourse, knowledge exchange and building, whereby active engagement between the education, research, and development sectors can make a significant contribution. Cultural institutions and museums can be important players in these transformational processes because they have a great deal of expertise in discussing and contextualizing controversial issues and reflecting on them historically. Such institutions, especially those with a diverse workforce dedicated to lowering barriers and promoting inclusion, also have an extensive repository of high-quality data. However, it must also be noted that the field of AI is marred by existing and emerging mechanisms of exclusion, which have also in-

tensified questions around digital and cultural inequality and participation (O'Neil 2017; Benjamin 2019; Crawford 2021).

The present volume addresses these open questions. It does not and cannot claim to answer them entirely or to offer a comprehensive overview of the topic of artificial intelligence in museums. Rather, the aim is to provide broad and polyphonic insights into the rapidly developing and changing field, to bring together a spectrum of theorists and practitioners from different national backgrounds, and to provide a basis for further discussion. The contributions are deliberately not based on a single definition of AI or solely on one particular concept. The common thread running through all the texts in this volume is that the field of artificial intelligence in museums urgently needs to be addressed and actively shaped so that the technological developments do not simply reshape museums from the outside. Against this backdrop, the goal of this introduction is to provide an overview of the volume as a whole and to highlight the larger topic areas. In accordance with the structure of the volume, it is divided into three sections: Reflections (1), Perspectives (2), and Applications (3).

Reflections

The use of AI is a complex business. While technical expertise is needed for its application, at least as important is systematic reflection on which technical liabilities and structural backgrounds are involved in the case of AI models, especially since most of them come from the hardly transparent context of globally operating corporations. Much-discussed examples of racial profiling or classist and gender-specific discrimination resulting from the biases in underlying data may not always present themselves as clearly in the context of the museum as in those of jurisdiction, social credit systems, or human resources databases. But this does not, of course, put the fundamental problems into perspective. In the opening paper of this section, 'The Role of Culture in the Intelligence of AI', Mercedes Bunz takes up these problems and begins by offering a broad *tour de horizon*. In view of the omnipresent misconceptions surrounding AI, she pleads for the alternative term 'machine intelligence'. In addition to reflecting on current processes, the cultural sector can benefit from very specific machine learning approaches so as to transfer literary methods such as 'distant readings' (Franco Moretti) and to find new connections in cultural data. Confronted with resource and exploitation problems, what is needed is a 'critical technical practice' (Phil Agre) that brings together various actors and stakeholders, engages with AI's own logics and error cultures, and uses its potential to cope with the ubiquitous flood of information.

The tension between theory and practice is central to the reflection on AI. In his paper, 'Why AI Cannot Think—A Theoretical Approach', Daniel Feige addresses the

recently much-discussed question of whether AI can develop a consciousness and possess reason. In antithesis to Turing, he argues that it is a grave mistake to open up the concept of intelligence to encompass the outputs of machines. Arguing based on phenomenological and analytical positions (especially that of John McDowell), a thinking being can only be spoken of if representations of the world are not only processed but also understood—his central thesis: a thinking being must be a bearer of some form of life. In his paper, 'AI and Art: Arguments for Practice', Arno Schubbach takes up the issue, rekindled by image generators such as Dall-E, of whether AI can be creative and produce art. In a fascinating recourse to the experimental works of Michael Noll from the 1960s, he argues that humans and their input are still the decisive factor in the production of art—the discussion should thus rather be about how AI can be productively integrated into creative practices. In her paper, 'The Hidden Costs of AI: Decolonization from Practice back to Theory', Oumaima Hajri focuses on the ethical and social aspects of AI. She reflects on the instrumental, infrastructural, and ideological dimensions of AI and argues for systematically asking the question of 'cui bono' and the associated discriminations against communities—recourse to theory can help to highlight the logics behind certain preconceptions, the language used, and clear tendencies towards 'whiteness' in the field of AI, before getting lost in technical solutions due to excessive practice.

Museums need to consider these problems when setting up AI projects. In his paper, 'Dead End or Way Out? Generating Critical Information about Painting Collections with AI', Lukas Fuchsgruber picks up where Hajri leaves off with her general observations. In the concrete context of museums, he argues emphatically against a tech-solutionism that can supposedly solve all problems such as better accessibility or democratization. Rather, museums should make their handling of AI—from invisible work on data to cooperation with commercial partners—completely transparent, rely on broad cooperation in the production of data, and understand it above all as a social question. In her paper, 'Power, Data and Control: AI in the Museum', Oonagh Murphy goes on to ask how museums experimenting with AI renegotiate power relations within the context of museum collections and visitor management. As helpful frameworks, she introduces the 'Data Ethics Canvas', the approach of 'Consequence Scanning', and the 'Museums + AI Toolkit', which she co-developed (Murphy/Villaespesa 2022). In her paper, 'Managing AI: Developing Strategic and Ethical Guidelines for Museums', Sonja Thiel gives a more concrete insight into the development of guidelines for the project Creative User Empowerment. She places particular emphasis on reflecting the normative preconditions and frameworks of AI projects, stresses the importance of the conscious use of large language models and the open handling of data, and points to the requirement of clearly defining the problem to be solved with AI.

Finally, the increasing use of AI in museums is itself an important object of research and study. Christoph Bareither outlines an approach to this in his paper, 'Mu-

seum-AI Assemblages: A Conceptual Framework for Ethnographic and Qualitative Research'. He draws on the concept of assemblage (Gilles Deleuze/Felix Guattari/Manuel DeLanda), which has already proven its value in the context of museum studies and digital transformation and is well suited to developing it further into a 'museum-AI assemblage' and systematically investigating the constantly changing relationships between AI, humans, and objects; the paper is not yet an empirical study, which means that the approach is applied to the example of a museum chatbot in a tentative way. When one takes the papers in this section together, from the general reflection on AI, to its ethically responsible application in museums, to the critical investigation of the AI-supported museum, the question of power and authority of interpretation then runs through it like a thread. Does the new technology reproduce existing power relations, reinforce them, or simply establish new ones? Or to move on to the next section: Can it also open up new perspectives with the necessary reflection, contribute to the dismantling of unfair power relations, and make museums accessible to more people?

Perspectives

The application of AI in museums is surprisingly broad and diverse. Surveys of the international museum world have brought to light a multitude of AI projects that are working on better understanding analogue and digital visitors and their behaviour, developing new museum experiences through chatbots and other applications, systematically tackling the data foundation of museums, or tentatively exploring the changes in museum work. Many research projects in recent years have developed solutions that can serve as inspiration and be used as an opensource basis for further research and development. Undoubtedly, such approaches will become even more diverse in the coming years. The section on 'Perspectives' therefore opens with Baptiste Caramiaux's paper, 'AI *with* Museums and Cultural Heritage', which systematically explores the potential opportunities that AI brings to museums and the field of cultural heritage, but also emphasizes the need to consider the sociocultural and sociotechnical implications of its implementation.

In order to develop perspectives in the field of AI, overview, best practices, and funding are needed. Isabel Hufschmidt's paper, 'Troubleshoot? A Global Mapping of AI in Museums', presents a global mapping of AI usage in museums, with the aim of understanding the motivations, contexts, goals, and challenges surrounding its adoption. Concrete best-practice examples from the library and archive sector, as well as from the field of data processing, are intended to point the way to current and future cultural data practices. Clemens Neudecker's paper, 'Digital Curation and Collections for AI: Opportunities and Risks for Cultural Heritage Institutions', highlights the benefits of AI for digitization and curation in cultural heritage

institutions, but also raises concerns about applying black-box technologies without fully understanding the consequences. Fabio Mariani, Lynn Rother, and Max Koss show in their paper, 'Teaching Provenance to AI: An Annotation Scheme for Museum Data', how AI can transform museum provenance records into structured data using natural language processing (NLP) techniques, thus facilitating large-scale object history analysis. The paper proposes a provenance-specific annotation scheme to preserve historical nuances in constructing 'provenance linked open data' (PLOD). Finally, Tabea Golgath's paper, 'The Funding Program LINK—AI and Culture: Five Lessons Learned after Five Years', reflects on the impact of AI on culture, examining how AI is applied in cultural contexts, its implications for human artists, and the changing concept of authorship.

In the development of AI art has played and continues to play a crucial role and might further transform and redesign creative processes. The increase in generative AI and especially large language models (LLMs) has led to a distortion of the public perception of what is meant by AI. At the same time, the technology has made astonishing leaps in development in only a short time, which is well illustrated by the transition from GPT 2 to 3 and 4. Luba Elliott's paper, 'Discovering Culture with AI', provides an overview of creative AI practices by cultural institutions, presents artistic explorations with AI, and highlights tools for public engagement with museum collections; artistic productions by artists such as Mario Klingemann or Anna Ridler open up the reflective power of art on technology, making generative and multimodal technologies tangible. In her paper 'Post-Truth. Archives, GPT-2, and Fake News', Marion Carré shows how technology is already challenging the 'archives' and presents a project that uses GPT-2 for the creation of fictitious archives and affects questions about the authenticity and reliability of information. On the flip side, Roland Fischer's paper, 'Imposter Syndrome: GPT-3 between Fact and Fiction', examines the role of storytelling and fiction in the context of GPT-3, shedding light on the blurred boundaries between human- and machine-generated content. Taken together, the papers in this section offer helpful perspectives and possibilities on how cultural institutions can approach the field of AI and redefine their role as spaces for reflection, discourse, and education in the culture of digitality.

Applications

Despite the large number of ongoing projects, applications and implementations of AI in museums are still in their infancy. To make the topic even more concrete and tangible, the last part of the volume presents a selection of projects, mainly from German-speaking museum practice, that have been implemented between 2018 and 2023. Due to the boom around ChatGPT, the number will most likely increase rapidly in the coming years, not least due to out-of-the-box solutions from

commercial providers. The focus here is deliberately on non-commercial and in many cases directly reusable projects that address new approaches to curation, interaction and visitor experience. Following the broader reflections and future-oriented perspectives, these practical applications from research and development can serve as inspirations for further discourse and new concepts.

An exciting question is how curation will change through and with AI. One of the earliest and quite innovative examples of curating with artificial intelligence is presented by the researcher and artist Tillmann Ohm. In his paper, 'Algorithmic Exhibition-Making: Curating with Networks and Word Embeddings', he describes the use of network analysis and word embeddings to artificially curate an exhibition. The focus is on efficiently linking artworks and keywords to create coherent and thematically focussed exhibitions. Creating processes in the digital world opens up interesting new perspectives that result from the possibility to combine digital objects from all over the works to create new connections, combinations, and insights. This requires a different mindset than siloed dataspaces and a willingness to cooperate and to build shared and sustainable infrastructures, like the Europeana, the European Digital Heritage Cloud, or other alliances—one example is presented by Nicole High-Steskal and Rainer Simon in their paper, 'Evaluating the Blackbox: Linking Viennese Art through AI', with the pilot project LiviaAI, in which AI is used to identify connections between objects from three Viennese museums. The aim of the project is to develop a model that learns similar visual representations across different collections. Similarly, 'Clouds of Symbols: The Digital Curator Project' by Lukáš Pilka presents an experimental web application that aims to recognize symbols and motifs in historical artworks. Here a proprietary neural network is used to perform iconographic analysis of an extensive database of artworks from various museums in Central Europe.

Which AI-driven tools can help to navigate through huge cultural heritage collections and what is the public's need when using them? In their paper 'xCurator—AI-Supported Exploration and Curation of Digital Collections', Sonja Thiel and Etienne Posthumus present an AI-based curation tool designed to make digital collections in museums more accessible and to encourage users to curate the collections themselves. Furthermore, several user studies were conducted as well as experimental spaces opened up in order to research the added value of AI technologies for museum purposes. The tool itself is developed opensource and aligns with basic museological norm data, which means that it can be adapted to future developments. Besides the Creative User Empowerment project, the 'intelligent.museum' project at the ZKM and the Deutsches Museum explored the options of applying AI in museums in a broader sense. In 'Say the Image, Don't Make It: Empowering Human-AI Co-Creation through the Interactive Installation *Wishing Well*', Yannick Hofmann and Cecilia Preiss present one example, in which the wishes and dreams of exhibition visitors are transformed into images using a text-to-picture model.

Chatbot interactions have the potential to enhance the visitor experience through personalized guidance and interaction and providing access regardless of location or person. They offer direct answers to questions, explain works of art, share interesting stories, and help with navigation. They also provide access to museum content outside of opening hours and can enhance educational experiences. At the same time, well-designed bots are in tune with current user behaviour, which is not only about interacting with digital content, but also engaging in communicative interaction. It might be useful to remember in the future that there was a time before the development of large language models, and in 'CHIM—Chatbot in the Museum: Exploring and Explaining Museum Objects with Speech-Based AI', Oliver Guske, Stefan Schaffer, and Aaron Ruß present an example of early research at the Städel Museum that has developed a chatbot prototype trained to answer open-ended questions about museum objects. Similarly, in 'With AI to Art! Chatting with Helen of Troy and Co. through IBM Watson', Melanie Fahden and Anja Gebauer show the development of an AI-based chatbot that enables lively conversations with six artificial characters and thus a potential role of chatbots in museum education. The paper by Ana Müller, Michael Schiffmann, Anke Neumeister, and Anja Richert, 'Exploring Beyond the Exhibits: Creating Knowledge for Social Robots in Public Spaces', closes the section about bot-interaction by evaluating how visitors interact with a social robot connected to an artificial intelligence dialogue system.

One important and sensitive field of application is the topic of visitor tracking and the use of visitor data. The contribution by Franz Koeferl, Matthias Zuerl, Jitin Jami, Jindong Li, Dario Zanca, and Bjoern Eskofier, 'Tracking the Visitor. Optical Indoor System for Visitor Research in Museum', proposes a large-scale optical tracking pipeline using person detection and a framework for collecting this data with visitor consent. Finally, in 'Symotiv: Virtual Insights into the Symphony Orchestra' Michael Zöllner, Markus Bosl, Dirk Widmann, and Moritz Krause describe the use of motion capture and VR/AR to analyse and present the workings of a symphony orchestra to a wider audience and give a hint at the end on how to transform a digital experience into a physical and inclusive experience. Collectively, these papers demonstrate that AI technologies have the potential to enrich and expand museum practice in many ways, from collection management to exhibition design, and visitor interaction. They provide important insights into the opportunities and challenges associated with implementing AI in the museum sector.

References

Badisches Landesmuseum Karlsruhe (2022): Cultures of Artificial Intelligence. New Perspectivs for Museums. Conference Programme. Available online at https://www.landesmuseum.de/conference-cultures-of-ai-program.

Benjamin, Ruha (2019). Race after Technology: Abolitionist Tools for the New Jim Code. Cambridge/Medford, Polity.

Brown, Dan (2017). Origin. London, Bantam Press.

Budelacci, Orlando (2022). Mensch, Maschine, Identität. Ethik der Künstlichen Intelligenz. Basel, Schwabe Verlag. https://doi.org/10.24894/978-3-7965-4634-1.

Chui, Michael/Hazan, Eric/Roberts, Roger et al. (2023). The Economic Potential of Generative AI. The Next Productivity Frontier. New York, McKinsey & Company. Available online at https://www.mckinsey.de/news/presse/genai-ist-ein-hilfsmittel-um-die-produktivitaet-zu-steigern-und-das-globale-wirtschaftswachstum-anzukurbeln.

Crawford, Kate (2021). Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence. New Haven/London, Yale University Press. https://doi.org/10.12987/9780300252392.

Deutscher Ethikrat (2023). Mensch und Maschine – Herausforderungen durch Künstliche Intelligenz. Stellungnahme. Available online at https://www.ethikrat.org/fileadmin/Publikationen/Stellungnahmen/deutsch/stellungnahme-mensch-und-maschine.pdf.

Deutscher Kulturrat (2023). Künstliche Intelligenz: Welche Rolle spielt KI für die Kultur? Available online at https://www.kulturrat.de/presse/pressemitteilung/kuenstliche-intelligenz-welche-rolle-spielt-ki-fuer-die-kultur/.

Hochscherf, Tobias/Lätzel, Martin (Eds.) (2023). KI & Kultur: Chimäre oder Chance? Voraussetzungen – Anwendungen – Potentiale. Kiel/Hamburg, Wachholz Verlag. Available online at https://www.wachholtz-verlag.de/KI-Kultur-Chimaere-oder-Chance-Hardcover.html.

McCorduck, Pamela (2004). Machines Who Think. Natick, MA, Peters. https://doi.org/10.1201/9780429258985.

Moor, James (2011). The Dartmouth College Artificial Intelligence Conference. The Next Fifty Years. AI Magazine 27(4), 87–91. https://doi.org/10.1609/aimag.v27i4.1911.

Murphy, Oonagh/Villaespesa, Elena (2022). Künstliche Intelligenz und Museen. Ein Toolkit, translated and expanded by Johannes Bernhardt/Tabea Golgath/Sonja Thiel. London/Karlsruhe, Goldsmiths/Badisches Landesmuseum. Available online at https://www.landesmuseum.de/fileadmin/user_upload/Barrierefreie_PDFs/KI-und-Museen-Toolkit-web_UA.pdf.

Nilsson, Nils J. (2004). The Quest for Artificial Intelligence. Cambridge, Cambridge University Press. https://doi.org/10.1017/cbo9780511819346.

O'Neil, Cathy (2017). Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy. New York, Crown.

Seising, Rudolf (2021). Es denkt nicht! Die vergessenen Geschichten der KI. Frankfurt am Main/Wien/Zürich, Büchergilde Gutenberg.

Turing, Alan M. (1950). Computing Machinery and Intelligence. Mind LXI (236), 433–60. https://doi.org/10.1093/oso/9780198250791.003.0017.

Vater, Christian (2023). Turings Maschinen. Eine Problemstellung zwischen Wissenschafts- und Technikgeschichtsschreibung. Heidelberg, Universität Heidelberg.